

# **CAMDEN HARBOR CAMDEN MAINE**

**SURVEY  
(REVIEW OF REPORTS)**



**DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.**

**DECEMBER 1969**

## SYLLABUS

The Division Engineer has studied the request of local interests for breakwater improvements in Camden Harbor, Maine to provide protection for the recreational craft anchoring in the outer harbor. He finds that the benefits to be expected from provision of a system of breakwaters across the entrance to the outer harbor are insufficient to justify the cost for construction.

An alternate plan of improvement has been considered which would require construction of a 315-boat marina by local interests, protected by a rubble mound breakwater 895 feet long in Sherman Cove to be constructed by the Federal government. The estimated first cost of construction for the breakwater is \$1,700,000. The benefit-cost ratio is 1.25 to 1.0.

Because the proposed improvement would benefit recreational craft only, local interests would be required to contribute 50 percent of the breakwater construction cost. They report that they will not undertake harbor improvements at this time.

Therefore, the Division Engineer recommends no modification of the authorized Federal navigation project for Camden Harbor, Maine at this time.

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DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
424 TRAPELO ROAD  
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO:

NEDED-R

3 December 1969

SUBJECT: Survey (Review of Reports) Camden Harbor, Camden,  
Maine

Chief of Engineers  
ATTN: ENGCW-PD

AUTHORITY

1. This report is submitted in compliance with the following resolution adopted 27 April 1966, by the Committee on Public Works of the United States Senate:

"RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, that the Board of Engineers for Rivers and Harbors created under Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby, requested to review the report of the Chief of Engineers on Camden Harbor, Maine, transmitted to Congress on December 9, 1948, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to construction of a breakwater and other necessary improvements in the interest of navigation."

2. A study of survey scope was assigned by the Chief of Engineers to the New England Division Engineer on 6 May 1966.

PURPOSE AND EXTENT OF STUDY

3. Studies have been made to determine the need and economic justification for modifying the existing Federal navigation project in Camden Harbor by providing breakwater protection for the outer harbor. A hydrographic survey was made to determine the most practicable location for breakwater structures. Quantity and cost estimates for various breakwater plans were also compiled. Available maps, past records, commercial statistics and other data pertaining to the harbor have been examined. A public hearing was held and supplemented by discussions with local interests.

## DESCRIPTION

4. Camden Harbor is located on the westerly side of West Penobscot Bay, about 6 miles north of Rockland and 88 miles northeast of Portland, Maine. It consists of an outer and inner harbor, the outer harbor being rectangular and extending inland about 550 yards with a width of about 1,100 yards. The inner harbor is a narrow inlet varying from 100 to 175 yards in width extending about 350 yards inland from the southwest corner of the outer harbor. The entire harbor has an area of about 175 acres with a depth exceeding 6 feet at mean low water. The outer harbor has a broad entrance between Northeast Point on the north and Curtis Island about 800 yards to the south. Depths in the harbor and entrance range from 6 feet to 37 feet. The inner harbor has been dredged to a depth of 10 feet.

5. The outer harbor is exposed to easterly winds, while the inner harbor is partially protected from winds from all directions. The mean and spring tide ranges are 9.6 and 11.6 feet, respectively. Ice sometimes forms in the harbor from January to March, but is not usual in the outer harbor, as it is cleared by westerly winds. The locality is shown on United States Coast and Geodetic Survey Charts 209, 310, and 1203 and the map accompanying this report.

6. There are no bridges crossing any portion of the waterway under consideration.

## TRIBUTARY AREA

7. The area tributary to Camden Harbor, an important recreational boating center, is the Town of Camden. The permanent population was 3,988 in 1960, largely concentrated at the head of the harbor. During the summer months the population is substantially increased by summer residents and tourists. The principal occupations of the town are the manufacture of woollen goods, boat-building, and catering to the needs of boat owners and tourists. The town is located on United States Highway Route 1. There are no local railroad facilities. Bus lines provide connections with other cities and towns.

## PRIOR REPORTS

8. Camden Harbor has been the subject of investigations and reports dating back to 1872. These reports are listed below:

<u>Published In</u>	<u>Type and Date of Report of Chief of Engineers</u>	<u>Work Considered &amp; Recommendation</u>
H. D. No. 141 50th Congress 1st Session	Survey Report dtd 2 Feb 1888	Favorable to deepening entrance channel to 12 ft., main harbor to 10 ft. and small channels in upper harbor to 5 ft.
H. D. No. 263 56th Congress 1st Session	Survey Report dtd 6 January 1900	Favorable to dredging in front of Boston & Bangor Steamship Co. to 14 ft.
H. D. 1117 60th Congress 2nd Session	Survey Report dtd 3 Dec 1908	Dredging additional area in upper harbor to 10 ft.
H. D. No. 1093 62nd Congress 3rd Session	Preliminary Examination dtd 21 Oct 1912	Unfavorable to breakwater construc- tion from mainland to Curtis Island
Unpublished	Preliminary (1) Examination dtd 13 Dec 1920	Unfavorable to deepening harbor to 17 ft.
Unpublished	Preliminary (1) Examination dtd 14 Sep 1927	Unfavorable to deepening harbor to 17 ft.
Unpublished	Survey Report (1) dtd 29 Jan 1932	Unfavorable to deepening the outer harbor to 17 ft.
Unpublished	Survey Report dtd 9 Dec 1948	Unfavorable to construction of breakwater on outer ledges

(1) Date of Division Engineer's Report.

## EXISTING CORPS OF ENGINEERS PROJECTS

9. The existing project authorized by Acts of 1888, 1902 and 1910 provides for a channel 14 feet deep at mean low water in the outer harbor and the main part of the inner harbor, and 10 feet deep in the upper portion of the harbor. The existing project was completed in 1911. Total Federal costs for the existing project were \$179,121 of which \$72,400 was for new work and \$106,721 was for maintenance.

## LOCAL COOPERATION ON EXISTING AND PRIOR PROJECTS

10. Local cooperation was not required for the existing project. The survey report submitted in 1948 found the harbor worthy of further Federal improvements but recommended no project modification because local interests could not at that time meet the necessary one-third cash contribution. The estimated cost for construction of an "Outer Ledge" breakwater was \$212,800 at 1946 price levels.

## OTHER IMPROVEMENTS

11. The Camden Shipbuilding and Marine Railway Company dredged a berth in their fitting-out pier to a depth of 16 feet at mean low water in 1943. Additional dredging was done in 1944 to extend this berth. In 1966, the Town of Camden dredged an area 75 feet by 20 feet to a depth of 14 feet (mlw) adjacent to the northwest corner of the Federal anchorage in the inner harbor to provide a berthing area at the town landing. No other improvements to the harbor have been made by either the State of Maine or local interests.

## TERMINAL AND TRANSFER FACILITIES

12. There are 9 wharves in the inner harbor with depths alongside ranging from 6 to 10 feet on the west side of the harbor and to 14 feet at the marina on the east side. The town landing consists of two floats located on the west side near the head of the harbor. A public launching ramp is located at Eaton Point. Local interests state the ramp is dangerous most of the time for boat launching and many capsizings have resulted. There are three private landings in the outer harbor and two in the inner harbor including one at the Camden Yacht Club located on the west side of the harbor. The yacht club has a four float landing with depths of 4 to 6 feet alongside. Guest moorings are maintained in the outer harbor.

13. Six boatyard repair and service facilities are located in the inner harbor where craft up to 45 feet long can be hauled out for hull and engine repairs or for open or covered winter storage. Overnight berthing space and wharfage with electricity are available at several wharves. The boatyard and marina on Eaton Point has a marine railway capable of handling craft up to 55 feet in length. The marina has a 20-ton and a 5-ton crane. A lock-marina on the west side of the inner harbor can lift craft up to 43 feet in length in the lock to a pool, which has a drydock and storage for 50 boats. This marina has 150 feet of float landings at harbor level with 7 feet of depth alongside.

#### IMPROVEMENT DESIRED

14. In order to afford local interests an opportunity to express their views concerning the extent, character and need for modification to the existing Federal navigation project, a public hearing was held at Camden, Maine on 26 May 1967. A total of 68 persons attended, including representatives of Federal, state and local governments, commercial fishermen, local businessmen and recreational boating interests of Camden and nearby towns.

15. A plan of improvement was presented by the Camden Harbor Breakwater Committee. The spokesman explained the difficulties experienced by fishing and recreational craft in using the harbor without adequate protection from severe southeasterly storms which cause extensive damage to shore property and boats in the outer harbor.

16. The desired plan of improvement presented consists of three rubble mound breakwaters. One would follow the line of the existing outer ledges south of Northeast Point, similar to that proposed for the report under review. A second breakwater would begin near the northerly point of Curtis Island running from Curtis Island in an east-northeasterly direction approximately 400 feet. The third breakwater would connect Dillingham Point to Curtis Island, and thus provide a causeway to the island as desired by local interests.

#### EXISTING AND PROSPECTIVE COMMERCE

17. The size of the commercial fishing fleet using the harbor is dependent upon fishing conditions in Penobscot Bay. The harbor may at times contain as many as 20 full-time and 10 part-time lobster



boats, from four to ten herring seiners and up to 12 scallopers. The commerce reported in 1967 consisted of 50 tons of shellfish. The annual average shellfish landings during the five-year period through 1967 was 72 tons. No other product was reported.

18. The trend in commercial tonnage is slightly downward as evidenced by the following figures:

#### TABLE OF COMMERCIAL TONNAGE

##### CAMDEN HARBOR, MAINE

1967	-	50 Tons
1966	-	72 Tons
1965	-	91 Tons
1964	-	65 Tons
1963	-	83 Tons
5 Year Average	-	72 Tons

The five year average through 1965 was 166 tons per year, further indicating the decline in commercial use.

#### VESSEL TRAFFIC

19. In 1967, 9,497 vessel trips were reported in Camden Harbor, and the total number of passengers carried on charter boat and scenic cruises was 21,612. At the public hearing, local people reported that 3,000 boats were serviced annually.

#### DIFFICULTIES ATTENDING NAVIGATION

20. Recreational boating has become increasingly popular among coastline communities. Camden, like other boating centers near large population concentrations, has been unable to keep up with the demand for mooring and dock facilities. The available safe anchorage areas for the recreational fleet have been exhausted. The outer harbor and part of the inner harbor are exposed and dangerous to small craft in storms from east through southeast. The outer harbor entrance and the outer harbor are relatively dangerous for most craft in any storm.

#### WATER POWER AND OTHER SPECIAL SUBJECTS

21. There are no problems pertaining to water power or other special subjects.

## PROJECT FORMULATION

22. The object of the study was to determine a plan of improvement which could be economically justified and yield the maximum net benefits while giving full consideration to preservation of the existing marine ecology of the area, maintenance of other desirable features of the harbor, and the desires of local interests.

23. The locally proposed plan of improvement consisting of three breakwaters was investigated to determine whether the breakwaters would produce the desired results and to estimate the costs and benefits of such a plan. Wave refraction and diffraction studies were made to determine the effectiveness of the breakwaters. It was found that due to the depth and alignment of the natural channel between Northeast Point and Curtis Island, waves approaching from the east and southeast, the predominant storm waves entering the harbor, would maintain a significant portion of their height all the way to the depth of breaking. Because of this, the proposed breakwaters would not reduce wave action to a safe level in the outer harbor. The estimated benefit-cost ratio of the plan was 0.2. The detailed analysis is contained in Appendix A. Several plans using alternative breakwater locations were studied, but all yielded the same ineffective, uneconomical results. These plans also are briefly summarized in Appendix A.

24. Since major breakwater improvements designed to provide protection for the open mooring capacity of the outer harbor were not feasible, studies were made to see if effective and economical results could be obtained through other alternative means of improvement. The possibility of providing Federal breakwater protection for non-Federal marina development in one of the coves within the outer harbor was investigated. Two possible sites were selected for study and estimates of costs of appropriate breakwaters and marina construction were made. Annual benefits to the recreational boating were also estimated. This approach was found to yield marginal economic results although providing adequately for the present and prospective boating use. A major drawback of the plan is the high first cost to the town.

25. The two sites investigated were Sherman Cove and the area just north of Dillingham Point. With improvement, the prospective growth of the existing fleet of 120 boats was estimated to bring the total number of boats to 360 at the end of the 50-year project life, not

including 30 equivalent transient boats. The growth is based on an average annual increase of 4 percent which is somewhat lower than the national average. Since 75 boats can be accommodated in the inner harbor, the capacity of any proposed marina should be at least 390 boats less 75 or 315 boats. Quantity and cost estimates for breakwater protection and access dredging to the marina were made for each location. The results of these calculations are:

<u>Location</u>	<u>Annual Federal Cost</u>	<u>Annual Benefits</u>	<u>Benefit/Cost Ratio</u>
Sherman Cove	\$104,900	\$131,700	1.25
Dillingham Point	\$113,000	\$131,700	1.17

Based on these values, Sherman Cove was determined to be the more economical location for a marina.

#### PLAN OF IMPROVEMENT

26. The plan of improvement considered to meet the need for more protected anchorage in Camden Harbor consists of a breakwater, a dredged channel and maneuvering area, and a marina located in Sherman Cove on the northerly side of the outer harbor. The breakwater would extend 895 feet in a northwesterly direction from the easterly shoreline of Sherman Cove and about half-way between Northeast Point and the mean high water level at the northern extremity of Sherman Cove. The dredged channel and maneuvering area would be located along the northwest side of the proposed marina. It would contain 1 1/2 acres and be available for limited open mooring for those people who desire to use the public landing facilities but do not wish to make use of the marina. A 315-boat marina would be situated to the northeast of the breakwater along the shoreline of the cove. Considerable dredging would be necessary to provide adequate area and depth, as a large portion of the site is above mean low water level.

27. The particular location and orientation of the breakwater resulted from an analysis of wave refraction and diffraction and various cost estimates which indicated the optimum combination of breakwater construction costs and dredging requirements with respect to the amount of area protected. The proposed breakwater will reduce the wave height in the marina to less than two feet.

28. From the wave refraction and diffraction studies, the maximum wave height at the breakwater was found to be 7 feet. Considering the tide range, wave amplitude and expected wave run-up, the required crest elevation of the breakwater was calculated to be 20 feet above mean low water with a width of 10 feet. The shoreward slope was set at one on one, the natural angle of repose of rubble stone, because no significant waves are expected to develop in the shoreward area. The design wave height and the availability of satisfactory breakwater material led to the selection of a seaward slope of one on 1.5. The marina, maneuvering area, and access channel would be dredged to a depth of six feet below mean low water, to accommodate the largest boats expected to use the facility.

29. Approximately 1000 feet of shoreline along the easterly side of Sherman Cove would be required to construct the marina. Dredged material would be deposited in an approved offshore dumping ground.

#### SHORELINE CHANGES

30. Sherman Cove is a fairly well protected cove with waves approaching exclusively from the south and striking almost perpendicular to the shoreline. The proposed breakwater could deflect some of the wave energy to the northwest corner of the cove, probably causing a slight clockwise circulation of water along the northerly shoreline. However, the type of material comprising the beach is such that erosion is unlikely. Since there is no existing evidence of erosion and the breakwater will only slightly change the water circulation patterns, it is concluded that there would be no significant effect on the configuration of the adjacent shoreline.

#### REQUIRED AIDS TO NAVIGATION

31. Navigation aids would consist of buoys marking the entrance channel and a light on the seaward end of the breakwater. The Coast Guard has not been contacted and cost estimates used herein are based on costs estimated for similar improvements.

#### ESTIMATE OF FIRST COSTS

32. Federal construction under the proposed plan of improvement would consist of an 895-foot long rubble mound breakwater and removal of ordinary material for an access channel and maneuvering basin in association with marina construction. The cost estimate is based on October 1969 price levels and includes an allowance for contingencies, engineering, design, supervision and administration for construction of the breakwater, entrance channel and turning basin.

## Project Cost Estimate

Rubble Mound Breakwater	72, 900 Tons @ \$15	\$ 1, 093, 500
Breakwater Bedding	10, 000 Tons @ \$6	<u>60, 000</u>
		\$ 1, 153, 500
Contingencies 20%		<u>230, 700</u>
Total Breakwater Cost		\$ 1, 384, 200
Dredging	19, 500 c. y. @ \$4	78, 000
Contingencies 20%		<u>15, 600</u>
		93, 600
Engineering & Design		103, 000
Supervision & Administration		<u>118, 000</u>
Total First Cost of Construction		\$ 1, 698, 800
Aids to Navigation (Coast Guard)		<u>3, 000</u>
		\$1, 701, 800
		* Say \$1, 700, 000

\* Exclusive of study costs.

## ESTIMATE OF ANNUAL CHARGES

33. The estimated annual charges for the considered plan are based on an anticipated project life of 50 years and an interest rate of 4.875% for both Federal and local cost shares. Annual maintenance charges are based on experience with similar projects. See paragraph 43 for details of local cost share.

### Federal Annual Charges

Interest and Amortization	
\$850, 900 x 0.0537	= \$ 45, 700
Annual Maintenance	
Breakwater	7, 400
Dredging	5, 700
Aids to Navigation	<u>400</u>
Sub-Total	\$ 59, 200

### Non-Federal Annual Charges

Interest and Amortization  
 $\$850,900 \times 0.0537 =$

\$ 45,700\*

Total Annual Charges

\$ 104,900

\*Note: Marina construction costs would be self-liquidating through user fees and are not included.

### ESTIMATE OF BENEFITS

34. Recreational boating would receive significant benefits from breakwater construction. Safe dockage would be provided for the boats which now moor in the exposed outer harbor, and for any new boats which would join the fleet during the life of the project. Benefits would accrue from greater boat usage because of safer and more convenient access and from reduction of damages caused by wave action.

35. There is no reason to attribute any increased fish or shellfish catch from the improvements, so no commercial fishing benefits are anticipated from the project.

36. Recreational benefits have been computed on the basis of annual net return to the owners if the boats were for hire. This net return varies with the size and type of boat and is expressed in terms of its average depreciated value. The ideal net return is considered the maximum return that could be obtained with full unrestricted use of the harbor. For Camden Harbor, the ideal net return varies from 14 percent for the smaller boats to 7 percent for the larger craft. This variation in the ideal percentage is based on assessment of the length of the season, concentration of population, costs of alternative types of outdoor recreation and income range of the using public. An estimate was made of the percent of optimum use which could be received with the proposed improvement. The difference or gain between the two conditions was considered to be the benefit.

37. The existing locally based fleet consists of 120 boats, 22 of which are commercial in nature, the others are recreational. The inner harbor could accommodate 53 recreational boats and all the commercial craft. These would not be affected by the project and, therefore, will not realize any benefits. The remaining 45 boats

which currently moor in the outer harbor will realize benefits through increased usage and reduced storm damage. In addition, there are a large number of transient boats which use the harbor and realize the same benefits as the local fleet. It is estimated that a total of 2000 visits are made by transient craft each year. This is equivalent to 20 boats based locally for the entire 100 day boating season. There would also be a growth in the number of transient boats to visit the harbor. The proposed facilities are expected to attract 10 equivalent transient boats (1,000 boats-day per year) by the end of the project life.

38. Based on the past boating growth record at Camden Harbor, the general growth record along the Maine coast, and the area economic situation, permanent locally based recreational boating population is expected to increase at an average rate of about 4% annually over the life of the project. This will result in a total recreational fleet of 390 boats after 50 years. Composition of the recreation fleet is estimated as follows:

Existing locally based fleet	120
Existing equivalent transients	20
Attracted equivalent transients	10
New boats immediately purchased	40
New boats-gradual growth	<u>200</u>
Total	390

39. Details of the annual benefits are shown in Tables I through V, Appendix A. A summary of those benefits is shown below:

<u>Type of Benefit</u>	<u>Amount</u>	
Increased Usage		
Existing Local Fleet	\$ 16,800	
Existing equivalent transients	<u>12,500</u>	
	\$ 29,300	\$ 29,300
Reduced Damage		
Existing local fleet	9,000	
Existing equivalent transients	<u>4,000</u>	
	\$ 13,000	\$ 13,000

<u>Type of Benefit</u>	<u>Amount</u>	
New Boats		
Immediately purchased	\$ 30,500	
Long term growth	53,500	
Equivalent transients	<u>5,400</u>	
	\$ 89,400	<u>\$ 89,400</u>
Total Benefits		\$131,700

#### APPORTIONMENT OF COSTS AMONG INTERESTS

40. Benefits that would result from improvement of Sherman Cove are considered to be 50 percent general and 50 percent local in nature since only recreational boats would benefit. The first cost of construction for the breakwater and dredging of the entrance channel and turning basin would be divided equally between the Federal government and local interests. The 315-boat marina is considered to be a local self-liquidating expense, that is, its capital and operating costs will be repaid from user charges.

##### Federal Investment

Corps of Engineers - 50% of \$1,700,000	\$ 850,000
U. S. Coast Guard, aids-to-navigation	<u>3,000</u>
Total Federal Cost	\$ 853,000

##### Non-Federal Investment

Cash Contribution - 50% of \$1,700,000	\$ 850,000
Marina - 315-boat slips and on shore facilities (self-liquidating)	<u>450,000</u>
Total Non-Federal Cost	\$1,303,000

#### COMPARISON OF BENEFITS AND COSTS

41. A comparison of the estimated benefits of \$131,700 and the estimated annual charges of \$104,900 yield a benefit-cost ratio of 1.25.



## PROPOSED LOCAL COOPERATION

42. The benefits to be derived from improvement of Camden Harbor are entirely recreational in nature. Local interests would be required to:

a. Contribute 50 percent of the first cost of construction of the Federal project, said contribution is currently estimated to be \$850,000.

b. Construct and maintain a public marina of at least 315 slips containing berthing depths, commensurate with the entrance channel depth, access roads, parking areas and other public use facilities open to all on equal terms. All slips and berthing facilities are to be provided outside the limits of the Federal project.

c. Hold and save the United States free from damage which may result from construction and maintenance of the project.

d. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project, including suitable spoil areas in the event that such areas are determined by the Chief of Engineers to be necessary for subsequent disposal of spoil and also necessary retaining dikes, bulkheads, or embankments therefore or the cost of such retaining works.

e. Regulate the use, growth and development of the harbor facilities with the understanding that they will be open to all on equal terms.

43. An estimate has been made for marina construction costs including dredging of berthing areas to provide a 315 boat marina in Sherman Cove. It would be necessary to construct a marina with a minimum capacity of 105 boats immediately upon construction of the Federal project with the remaining 210 slips to be added over the 50 year life span of the project.

## COORDINATION WITH OTHER AGENCIES

44. All Federal, state and local agencies considered to have an interest in the Camden Harbor study were notified of the Public Hearing held at Camden on 26 May 1967. Some of these agencies

have been consulted during the study concerning the effects of the proposed improvement on their activities.

## DISCUSSION

45. Camden Harbor is located on the west side of West Penobscot Bay, 88 miles northeast of Portland, Maine. It is one of the important recreational boating centers in the state and serves as the home port for commercial fishing vessels in the immediate area. With the excellent facilities for boat repairs and storage afforded by 6 local boat yards and a yacht club, the harbor attracts some 2,000 visiting recreational craft each year.

46. Camden residents believe the harbor's success as a popular summer resort depends to a great extent on its deep water natural anchorage in the outer harbor which is adequate for normal activities, but unsafe as an anchorage in easterly and southeasterly storms. These storms are reported to occur several times during the boating season and considerable damage is incurred by boats forced to remain in the anchorage because of lack of protected anchorage elsewhere in the vicinity.

47. To provide protection from storm damage, local interests desire rubble mound breakwaters constructed on the ledges at the entrance to the outer harbor. One breakwater would lie along the line of ledges extending south from Northeast Point. A second breakwater would extend northeasterly from Curtis Island, leaving a 500 foot wide opening for navigation. The third breakwater would connect Dillingham Point and Curtis Island. This 3-breakwater plan was studied and found to be uneconomic and ineffective.

48. Alternative plans were studied in an effort to provide protected open anchorage either at Northeast Point or in the area adjacent to Dillingham Point. However, neither of these areas would provide sufficient sheltered anchorage to justify breakwater protection. The one feasible alternative would be for local interests to construct a marina either in Sherman Cove or in the area north of Dillingham Point, protected by a Federal rubble mound breakwater. Marinas at these sites would provide room for prospective growth of the existing fleet over the life span of a project. It was found that a

315-boat marina at Sherman Cove would meet future needs. A rubble mound breakwater would be economically justified at either of these sites, but the Sherman Cove site proved to have the lower construction cost.

49. Development of marina facilities at either Sherman Cove or Dillingham Point would require considerable expense beyond the cost of actual marina construction to obtain the land and to provide convenient access from the business center of the town. The results of the study were discussed with local officials. They are unwilling to participate in the cost of the combined marina, breakwater project.

### CONCLUSIONS

50. The Division Engineer finds that there is a need for additional safe mooring facilities in Camden Harbor to allow for future growth of the recreational fleet. Protection of the existing outer harbor anchorage by construction of a system of breakwaters is not considered to be economical. A feasible but marginal alternative is the construction of a 315-boat marina located in Sherman Cove, protected by a rubble mound breakwater. However, local interests do not desire to meet the requirements of local cooperation and therefore, no improvement is recommended at this time.

### RECOMMENDATIONS

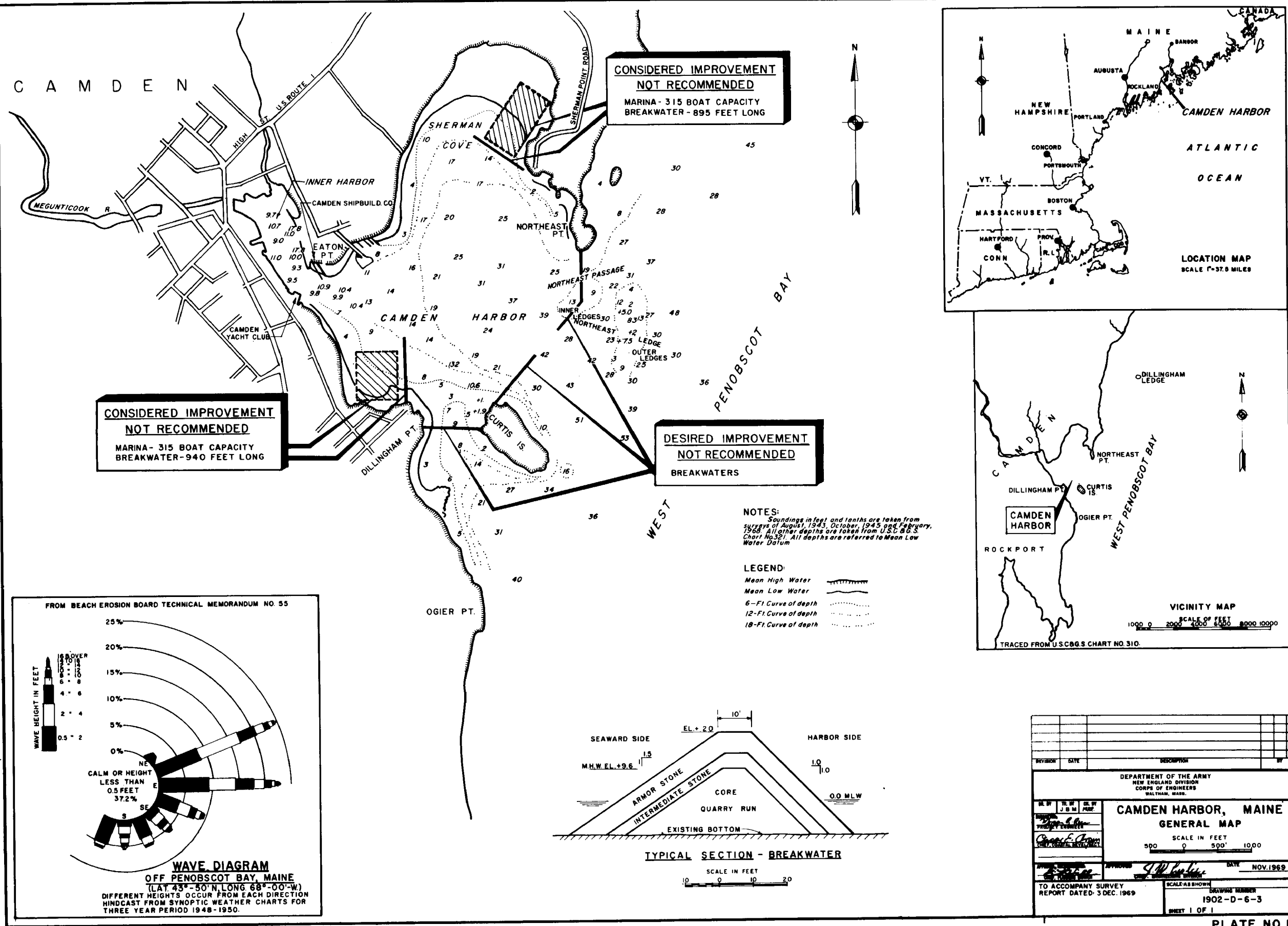
51. The Division Engineer recommends no modification to the existing Federal project at Camden Harbor, Camden, Maine at this time.

5 Incls

1. General Map
2. Appendix A
3. Appendix B
4. Appendix C
5. Senate Resolution 148

FRANK P. BANE

Colonel, Corps of Engineers  
Division Engineer



# APPENDIX A ALTERNATE IMPROVEMENT PLANS

## 1. Plan requested by local interests - Three breakwaters.

Description of Plan: Breakwater extending south from Northeast Point a distance of 680 feet, then southwesterly for a distance of 530 feet, totalling 1210 feet. A second breakwater extending from the northeast side of Curtis Island a distance of 850 feet leaving a 500 foot wide navigation opening between the two breakwaters. A third breakwater 840 feet long between Dillingham Point and Curtis Island. This plan would reduce wave heights along the shore of the outer harbor by approximately 60 percent and provide two anchorages, one on the southwest side of 23 acres and one on the northeast side of 50 acres, both with depths in excess of six feet.

### Project Cost:

Breakwater stone in place: 411,000 Tons @ \$15	\$6,165,000
Contingencies 20%	<u>1,233,000</u>
	7,398,000
Engineering & Design and Supervision & Administration	<u>1,110,000</u>
Total Construction Cost	\$8,508,000
Coast Guard Aids	30,000
Public Landings	<u>35,000</u>
Total Project Cost	\$8,573,000

### Annual Cost:

Interest & Amortization	
\$8,508,000 x 0.05372 =	\$ 457,000
Maintenance	
4,000 Tons @ \$17	68,000
Coast Guard Aids	<u>600</u>
Total Annual Charges	\$ 525,600

## 2. Annual Benefits

The benefits to boating from this plan are the same as for the proposed plan of improvement except that, since the outer harbor is still somewhat exposed, the future percent return is expected to be 90% of ideal rather than 100% as with a marina.

Accordingly, benefits to existing boats are reduced  $(90\%-60\%)/ (100\%-60\%) = 0.75$ , and benefits to future boats are reduced by  $\frac{90\%}{100\%} = 0.90$ .

Benefits to Existing Fleet	$\$29,300 \times 0.75 =$	\$ 22,000
Benefits to New Boats	$89,400 \times 0.90 =$	80,400
Reduced Boat Damage		13,000
Reduced Property Damage on Shore		<u>12,000</u>

Total Annual Benefits \$127,400

3. Benefit-Cost Ratio is  $\frac{\$127,400}{\$525,600} = 0.24$

## 4. Alternative Plan - Curtis Island Breakwater and Dillingham Point Breakwater

Description of Plan: Breakwater extending northeasterly from the northeast side of Curtis Island a distance of 850 feet. To provide flanking protection to the proposed anchorage on the south side of the outer harbor, a breakwater is necessary between Dillingham Point and Curtis Island, a distance of 840 feet. This plan would provide a protected anchorage of 23 acres with depths in excess of six feet, but would not significantly reduce wave heights along the shore of the outer harbor.

### Project Cost:

Stone in place: 248,000 Tons @ \$15	\$ 3,720,000
Contingencies - 20%	<u>744,000</u>
	\$ 4,464,000
Engineering and Design	357,000
Supervision and Administration	<u>312,000</u>
Total Construction Cost	\$ 5,133,000
Coast Guard Aids to Navigation	15,000
Public Landing	<u>20,000</u>
Total Project Cost	\$ 5,168,000

Annual Cost:

Interest and Amortization

\$5,133,000 x 0.05372                      \$ 275,700

Maintenance

Stone replacement: 2,500 Tons

@ \$17                      42,500

Coast Guard Aids to Navigation                      300

Total Annual Charges                      \$ 318,500

5. Annual Benefits

The benefits from this plan are derived similarly to the desired plan except that there is room for only 125 boats, limiting expansion of the fleet.

Benefits to Existing Fleet                      \$ 22,000

Benefits to New Boats                      33,400

Reduced Boat Damage                      13,000

Total Annual Benefits                      \$ 68,400

6. Benefit-cost ratio is  $\frac{\$68,400}{\$318,500} = 0.21$

7. Alternative Plan - Breakwater from Northeast Point

Description of Plan: Breakwater extending south from Northeast Point a distance of 680 feet, then southwesterly for a distance of 530 feet, a total length of 1210 feet. The protected anchorage behind the breakwater structure will contain 50 acres and have depths in excess of six feet. No protection would be provided existing shore facilities or to moorings in the outer and inner harbors. All craft using the outer harbor could be anchored behind the breakwater with a public landing at Northeast Point.

Project Cost:

Breakwater: Stone in place: 163,000 Tons @ \$17	\$ 2,770,000
Contingencies - 20%	<u>554,000</u>
	\$ 3,324,000
Engineering and Design	265,900
Supervision and Administration	<u>232,700</u>
Total Construction Cost	\$ 3,822,600
Coast Guard Aids to Navigation	15,000
Public Landing	<u>20,000</u>
Total Project Cost	\$ 3,857,600

Annual Cost:

Interest and Amortization	
\$3,822,600 x 0.05372 =	\$ 205,400
Maintenance	
1700 Tons @ \$18	30,600
Coast Guard Aids to Navigation	<u>300</u>
	\$ 236,300

8. Annual Benefits

Benefits are derived similarly to the desired plan except that the number of boats is limited to 225.

Benefits to Existing Fleet	\$ 22,000
Benefits to New Boats	56,300
Reduced Boat Damages	<u>13,000</u>

Total Annual Benefits \$ 91,300

9. Benefit-cost ratio:  $\frac{\$91,300}{\$236,300} = 0.39$

10. Alternative Plan - Dillingham Point Marina and Breakwater



Description of Plan: Breakwater extending 940 feet northerly from Dillingham Point protecting an area in which local interests would be required to construct a 315-boat marina. The natural depths in the approach to the marina location are sufficient for navigation, thus dredging of an access channel is not necessary.

Project Cost:

Breakwater stone in place: 84,300 Tons @ \$15	\$ 1,264,500
Bedding Stone: 10,500 Tons @ \$6	<u>63,000</u>
	\$ 1,327,500
Contingencies - 20%	<u>265,500</u>
	\$ 1,593,000
Engineering and Design	127,000
Supervision and Administration	<u>111,000</u>
Total Construction Cost	\$ 1,831,000
Aids to Navigation (Coast Guard)	<u>3,000</u>
	\$ 1,834,000

Annual Cost:

Interest and Amortization: \$1,834,000 x 0.05372	98,500
Maintenance	
830 Tons @ \$17	14,100
Navigation Aids	<u>400</u>
Total Annual Charges	\$ 113,000

11. Annual Benefits:

The benefits resulting from this plan are identical to those of the proposed plan of improvement. The marina, capacity, effectiveness, and accessibility are the same at either Dillingham Point or Sherman Cove. Benefits are therefore \$131,700.

12. Benefit-cost ratio is:  $\frac{\$131,700}{\$113,000} = 1.17$

TABLE I BENEFITS TO RECREATIONAL BOATING

Existing Permanently Based Fleet

HARBOR: CAMDEN HARBOR, MAINE					Length of Boating Season = 100 days							
TYPE OF CRAFT	LENGTH (feet)	NO. OF BOATS	DEPRECIATED VALUE		PERCENT RETURN				VALUE \$	ON CRUISE		
			AVERAGE \$	TOTAL \$	Ideal	% of Ideal		Gain		Avg. Days	% of Season	Value \$
						Pres.	Fut.					
RECREATIONAL FLEET												
Outboards	15-20	2	1,400	2,800	14	60	100	5.6	157	-	-	-
Inboards	15-20	1	2,600	2,600	12	60	100	4.8	125	-	-	-
	21-30	1	4,300	4,300	11	60	100	4.4	189	-	-	-
	31&Up	-	-	-	-	-	-	-	-	-	-	-
Sterndrive	15-20	-	-	-	-	-	-	-	-	-	-	-
	21-25	-	-	-	-	-	-	-	-	-	-	-
	26&Up	-	-	-	-	-	-	-	-	-	-	-
Cruisers	15-20	-	-	-	-	-	-	-	-	-	-	-
	21-30	6	6,500	39,000	9	60	100	3.6	1,404	10	10	140
	31-40	9	16,000	144,000	8	60	100	3.2	4,608	15	15	691
	41-50	4	40,000	160,000	8	60	100	3.2	5,120	15	15	768
	51&Up	1	76,000	76,000	7	60	100	2.8	2,128	20	20	425
Aux. Sail	15-20	-	-	-	-	-	-	-	-	-	-	-
	21-30	6	4,900	29,400	8	60	100	3.2	941	10	10	94
	31-40	10	14,400	144,000	8	60	100	3.2	4,608	15	15	691
	41&Up	-	-	-	-	-	-	-	-	-	-	-
Sailboats	8-15	-	-	-	-	-	-	-	-	-	-	-
	16-20	2	1,200	2,400	12	60	100	4.8	115	5	5	6
	21-25	3	2,100	6,300	11	60	100	4.4	277	10	10	28
	26&Up	-	-	-	-	-	-	-	-	-	-	-
TOTALS		45		610,800					19,672			2,843

\$19,672 - \$2,843 = \$16,829

SAY \$16,800

TABLE II BENEFITS TO RECREATIONAL BOATING

Equivalent Existing Transients

## HARBOR: CAMDEN HARBOR, MAINE

TYPE OF CRAFT	LENGTH (feet)	NO. OF BOATS	DEPRECIATED VALUE		PERCENT RETURN				VALUE \$	ON CRUISE		
			AVERAGE \$	TOTAL \$	Ideal	% of Ideal		Gain		Avg. Days	% of Season	Value \$
						Pres.	Fut.					
RECREATIONAL FLEET												
Outboards	15-20	-	-	-	-	-	-	-	-			
Inboards	15-20	-	-	-	-	-	-	-	-			
	21-30	-	-	-	-	-	-	-	-			
	31&Up	-	-	-	-	-	-	-	-			
Sterndrive	15-20	-	-	-	-	-	-	-	-			
	21-25	-	-	-	-	-	-	-	-			
	26&Up	-	-	-	-	-	-	-	-			
Cruisers	15-20	-	-	-	-	-	-	-	-			
	21-30	3	6,500	19,500	9	60	100	3.6	702			
	31-40	2	16,000	32,000	8	60	100	3.2	1,024			
	41-50	3	40,000	120,000	8	60	100	3.2	3,840			
	51&Up	1	76,000	76,000	7	60	100	2.8	2,128			
Aux. Sail	15-20	1	1,800	1,800	9	60	100	3.6	65			
	21-30	2	4,900	9,800	8	60	100	3.2	314			
	31-40	6	14,400	86,400	8	60	100	3.2	2,765			
	41&Up	2	30,000	60,000	7	60	100	2.8	1,680			
Sailboats	8-15	-	-	-	-	-	-	-	-			
	16-20	-	-	-	-	-	-	-	-			
	21-25	-	-	-	-	-	-	-	-			
	26&Up	-	-	-	-	-	-	-	-			
TOTALS		20		\$ 355,500					\$12,518			

SAY \$12,500

TABLE III BENEFITS TO RECREATIONAL BOATING

New Boats Immediately Purchased

HARBOR: CAMDEN HARBOR, MAINE

Length of Boating Season = 100 days

TYPE OF CRAFT	LENGTH (feet)	NO. OF BOATS	DEPRECIATED VALUE		PERCENT RETURN				VALUE \$	ON CRUISE		
			AVERAGE	TOTAL	Ideal	% of Ideal	Gain	Avg. Days		% of Season	Value	
			\$	\$		Pres.	Fut.				\$	
RECREATIONAL FLEET												
Outboards	15-20	-	-	-	-	-	-	-	-	-	-	-
Inboards	15-20	3	2,600	7,800	12	0	100	12	936	-	-	-
	21-30	2	4,300	8,600	11	0	100	11	946	-	-	-
	31&Up	1	16,000	16,000	10	0	100	10	1,600	-	-	-
Sterndrives	15-20	4	2,500	10,000	12	0	100	12	1,200	-	-	-
	21-25	4	4,500	18,000	11	0	100	11	1,980	-	-	-
	26&Up	2	9,800	19,600	10	0	100	10	1,960	-	-	-
Cruisers	15-20	-	-	-	-	-	-	-	-	-	-	-
	21-30	5	6,500	32,500	9	0	100	9	2,925	10	10	292
	31-40	4	16,000	64,000	8	0	100	8	5,120	15	15	768
	41-50	4	40,000	160,000	8	0	100	8	12,800	15	15	1,920
	51&Up	-	-	-	-	-	-	-	-	-	-	-
Aux. Sail	15-20	-	-	-	-	-	-	-	-	-	-	-
	21-30	3	4,900	14,700	8	0	100	8	1,176	10	10	118
	31-40	2	14,400	28,800	8	0	100	8	2,304	15	15	346
	41&Up	-	-	-	-	-	-	-	-	-	-	-
Sailboats	8-15	-	-	-	-	-	-	-	-	-	-	-
	16-20	3	1,200	3,600	12	0	100	12	432	5	5	22
	21-25	3	2,100	6,300	11	0	100	11	693	10	10	69
	26&Up	-	-	-	-	-	-	-	-	-	-	-
TOTALS		40		389,900					34,072			\$3,535

\$34,072 - \$3,535 = \$30,537 SAY \$30,500

TABLE IV BENEFITS TO RECREATIONAL BOATING

New Boats - Gradual Growth

HARBOR: CAMDEN HARBOR, MAINE

Length of Boating Season = 100 days

TYPE OF CRAFT	LENGTH (feet)	NO. OF BOATS	DEPRECIATED VALUE		PERCENT RETURN			VALUE \$	ON CRUISE			
			AVERAGE	TOTAL	Ideal	% of Ideal	Gain		Avg. Days	% of Season	Value	
			\$	\$		Pres.	Fut.				\$	
RECREATIONAL FLEET												
Outboards	15-20	-	-	-	-	-	-	-	-	-	-	-
Inboards	15-20	12	2,600	31,200	12	0	100	12	3,744	-	-	-
	21-30	12	4,300	51,600	11	0	100	11	5,676	-	-	-
	31&Up	8	16,000	128,000	10	0	100	10	12,800	-	-	-
Sterndrive	15-20	20	2,500	50,000	12	0	100	12	6,000	-	-	-
	21-25	16	4,500	72,000	11	0	100	11	7,920	-	-	-
	26&Up	8	9,800	78,400	10	0	100	10	7,840	-	-	-
Cruisers	15-20	-	-	-	-	-	-	-	-	-	-	-
	21-30	20	6,500	130,000	9	0	100	9	11,700	10	10	1,170
	31-40	20	16,000	320,000	8	0	100	8	25,600	15	15	3,840
	41-50	16	40,000	640,000	8	0	100	8	51,200	15	15	7,680
	51&Up	4	76,000	304,000	7	0	100	7	21,280	20	20	4,256
Aux. Sail	15-20	4	1,800	7,200	9	0	100	9	648	-	-	-
	21-30	12	4,900	58,800	8	0	100	8	4,704	10	10	470
	31-40	16	14,400	230,400	8	0	100	8	18,432	15	15	2,765
	41&Up	-	-	-	-	-	-	-	-	-	-	-
Sailboats	8-15	4	500	2,000	12	0	100	12	240	-	-	-
	16-20	12	1,200	14,400	12	0	100	12	1,728	5	5	86
	21-25	12	2,100	25,200	11	0	100	11	2,772	10	10	277
	26&Up	4	3,500	14,000	10	0	100	10	1,400	15	15	210
TOTALS		200		2,157,200					183,684			20,754

\$183,684-\$20,754 = \$162,930

Present Worth \$162,930 x 0.3283 = \$53,500

TABLE V BENEFITS TO RECREATIONAL BOATING

New Transient Boats - Gradual Growth

HARBOR: CAMDEN HARBOR, MAINE

TYPE OF CRAFT	LENGTH (feet)	NO. OF BOATS	DEPRECIATED VALUE		PERCENT RETURN			VALUE \$	ON CRUISE			
			AVERAGE	TOTAL	Ideal	% of Ideal			Gain	Avg. Days	% of Season	Value \$
			\$	\$		Pres.	Fut.					
RECREATIONAL FLEET												
Outboards	15-20	-	-	-	-	-	-	-	-	-	-	
Inboards	15-20	-	-	-	-	-	-	-	-	-	-	
	21-30	-	-	-	-	-	-	-	-	-	-	
	31&Up	-	-	-	-	-	-	-	-	-	-	
Sterndrive	15-20	-	-	-	-	-	-	-	-	-	-	
	21-25	-	-	-	-	-	-	-	-	-	-	
	26&Up	-	-	-	-	-	-	-	-	-	-	
Cruisers	15-20	-	-	-	-	-	-	-	-	-	-	
	21-30	-	-	-	-	-	-	-	-	-	-	
	31-40	3	16,000	48,000	8	0	100	8	3,840	-	-	
	41-50	3	40,000	120,000	8	0	100	8	9,600	-	-	
	51&Up	-	-	-	-	-	-	-	-	-	-	
Aux. Sail	15-20	-	-	-	-	-	-	-	-	-	-	
	21-30	2	4,900	9,800	8	0	100	8	784	-	-	
	31-40	2	14,400	28,800	8	0	100	8	2,304	-	-	
	41&Up	-	-	-	-	-	-	-	-	-	-	
Sailboats	8-15	-	-	-	-	-	-	-	-	-	-	
	16-20	-	-	-	-	-	-	-	-	-	-	
	21-25	-	-	-	-	-	-	-	-	-	-	
	26&Up	-	-	-	-	-	-	-	-	-	-	
TOTALS		10		\$206,600				\$16,528				

Present Worth  $\$16,528 \times 0.3283 = \$5,400$



APPENDIX B  
UNITED STATES  
DEPARTMENT OF THE INTERIOR  
FISH AND WILDLIFE SERVICE  
BUREAU OF SPORT FISHERIES AND WILDLIFE  
U. S. POST OFFICE AND COURTHOUSE  
BOSTON, MASSACHUSETTS 02109

December 9, 1969

Division Engineer  
New England Division  
U. S. Army Corps of Engineers  
424 Trapelo Road  
Waltham, Massachusetts 02154

Dear Sir:

This letter constitutes our conservation and development report concerning navigation improvements under consideration for Camden Harbor, at Camden (Knox County), Maine. The study is authorized by the Resolution of the Senate Committee on Public Works adopted April 27, 1966. This report has been prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-666 inc.), in cooperation with the Maine Departments of Sea and Shore Fisheries and Inland Fisheries and Game and has their concurrence as indicated by letters dated October 23, 1969 and November 17, 1969, respectively. It has also been coordinated with and represents the views of the Bureau of Commercial Fisheries.

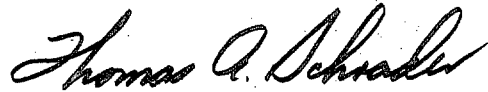
It is our understanding that navigation improvements which were considered consist of three stone breakwaters as follows: (1) a 1,200-foot breakwater on the "outer edge", running southerly from the black beacon, (2) a 400-foot breakwater running northeasterly from the northeastern part of Curtis Island, and (3) a causeway from Metcalf Point to Curtis Island. The improvements were considered for the primary purpose of providing a harbor of refuge for both commercial and recreational craft. Two alternate considerations were given; (a) to the construction of a 315-boat marina with associated breakwater and entrance channel at Sherman Cove and (b) to the construction of a 315-boat marina and associated breakwater at Dillingham Point.

We have been advised by your office that the improvements considered under (1), (2), and (3) above were found to be economically infeasible at this time, and that you will recommend no Federal participation.

We were further advised that each of the alternative improvements under (a) and (b) above were found to be economically justified. Local interests report, however, that they will not undertake harbor improvements at this time.

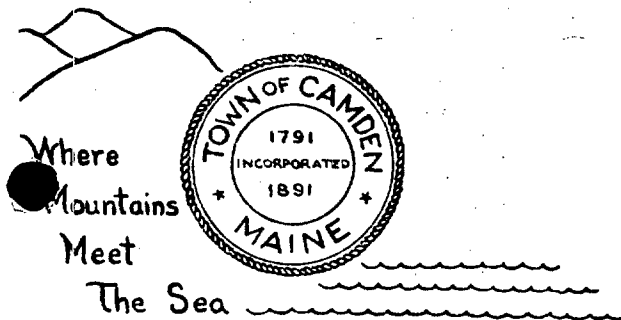
If improvements are considered for this area at a future date, we would appreciate early notification so as to have sufficient time to investigate and report on the plan.

Sincerely yours,

A handwritten signature in cursive script, reading "Thomas A. Schrader". The signature is written in dark ink and is positioned above the typed name.

Acting Regional Director





# Town of Camden, Maine 04843

OFFICE OF  
TOWN MANAGER  
236-3610

## APPENDIX C

September 16, 1969

New England Division  
Corps of Engineers  
424 Trapelo Road  
Waltham, Mass. 02154

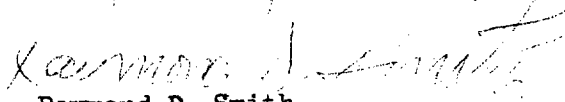
Gentlemen:

Re: Navigation Improvements  
Camden Harbor  
Camden, Maine

Friday afternoon, September 5, 1969, Mr. Rees and Mr. Guptill of the New England Division, Corps of Engineers, informed members of the Camden, Maine, Board of Selectmen, Planning Board, Harbor Committee and Town Manager of the results of the Corps of Engineers study of navigation improvements, with particular reference to construction of a breakwater, for Camden Harbor.

The Board of Selectmen, Planning Board, and Harbor Committee have carefully considered the improvement plan and alternate plans presented and have concluded that the Benefit Cost ratios attached thereto are not sufficient to support the initial investment required. The Town of Camden, therefore, will not now undertake the proposed harbor improvements.

Very truly yours,

  
Raymond D. Smith  
Town Manager

## CAMDEN HARBOR, CAMDEN, MAINE

Information called for by Senate Resolution 148, 85th Congress, adopted 28 January 1958.

### 1. Navigation Problem.

Camden Harbor is located on the westerly shore of West Penobscot Bay, 88 miles northeast of Portland, Maine and 6 miles north of Rockland, Maine. It consists of an outer and inner harbor. The inner harbor is a narrow inlet extending about 350 yards inland from the southwest corner of the outer harbor averaging about 150 feet in width. An existing Federal navigation project provides for a channel 14 feet deep at mean low water in the outer harbor and in the main part of the inner harbor and 10 feet deep in the upper portion of the inner harbor. The existing project was completed in 1911.

2. The principal navigation difficulty involves a lack of safe anchorage in the outer harbor which is exposed to easterly and southeasterly storms. For this reason, local interests have requested a plan for breakwater structures across the harbor entrance.

### 3. Improvements Considered.

Analysis of the problem indicates that breakwater protection at the harbor entrance would not provide a sufficient degree of protection to the existing anchorage. Several alternate plans were considered to provide breakwater protection for the existing fleet and allow room for future expansion. The most beneficial plan would consist of a breakwater 895 feet long extending in a northwesterly direction from Northeast Point across the entrance to Sherman Cove forming protection for the development of a 315-boat marina in the Cove. The estimated cost of this breakwater totals \$1,700,000. Since the improvement would only benefit recreational craft, local interests would be required to share in half the cost of breakwater construction in addition to providing a 315-boat marina. The total local cost share is estimated to be \$1,303,000. Computed average annual benefits total \$131,600 resulting in a benefit-cost ratio of 1.25 to 1.0.

### 4. Discussion.

Local interests reviewed the findings of the study and have indicated their awareness that protection of the existing outer harbor anchorage is not economical and that they would be unable to meet the requirements of local cooperation for developing a marina at Sherman Cove. They state that the town will not undertake harbor improvements at this time.